

CHAPTER 7

The Vertically Organized Brain in Clinical Psychiatric

Disorders

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Introduction

- Challenges in the neuropsychology diagnosis.

psychiatric disorders and the relationship with

Neuropsychology

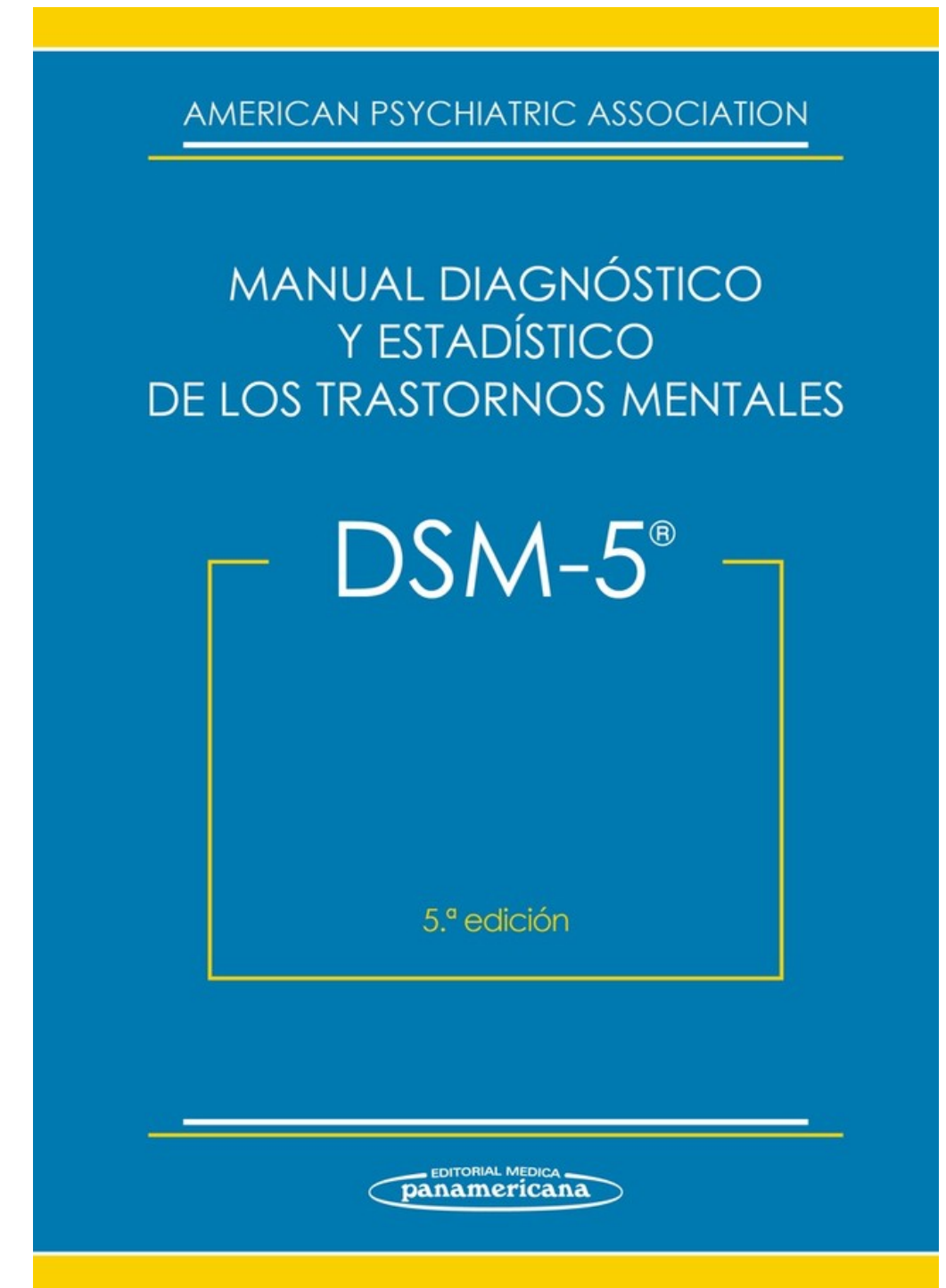
- Obsessive-Compulsive Disorder (OCD)
- Attention Deficit Hyperactivity Disorder
- Schizophrenia
- Autism Spectrum Disorder (ASD—including Asperger Syndrome)
- Mapping Anatomy and Symptomology
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Introduction

- The challenges face by neuropsychology in diagnostic clinical psychiatric disorders.



In the relation to the DSM approach and the need to integrate understanding of the relationships between the brain and behavior in the diagnostic process.



DIAGNOSIS

DSM

- Emotional and cognitive components through behavioral observations or reports.

NEUROPSYCHOLOGY

- The relation between brain – behavior
- Neuroanatomical bases



- Propose an alternative system:

- Observable behavior
- Brain – behavior

relationships

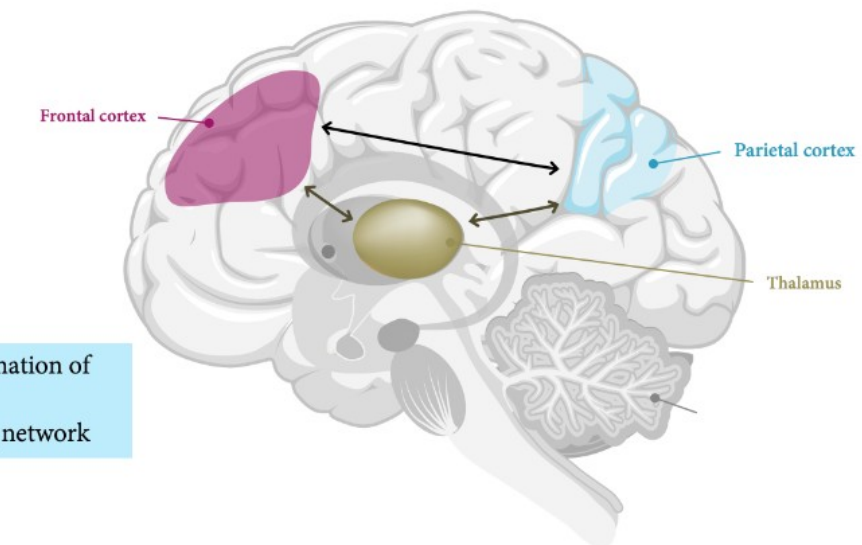
understanding of the patient's cognition
irrespective of diagnostic label – but contributes a
specific label.

1. Obsessive-Compulsive Disorder (OCD)

- Obsessive-compulsive disorder (OCD) is a classic condition involving the **frontostriatal system**.
- Abnormal activity has been identified within **the orbitofrontal cortex, dorsolateral prefrontal cortex, anterior cingulate cortex, caudate nucleus, and within the thalamus**.



Frontoparietal network



- Involved in coordination of cognitive control
- Part of the alerting network

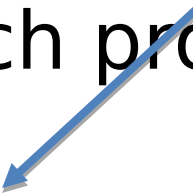
Stein DJ, Costa DLC, Lochner C, Miguel EC, Reddy YCJ, Shavitt RG, van den Heuvel OA, Simpson HB. Obsessive-compulsive disorder. Nat Rev Dis Primers. 2019 Aug 1;5(1):52.

1.1 Symptomatic Manifestations and Brain

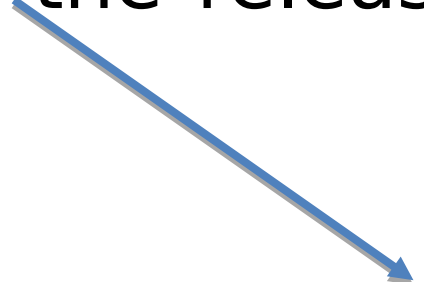
- Hyperactivity in orbitofrontal and medial circuits is associated with the **repetition of ideas or behaviors.**

Circuits

- The direct pathway is responsible for selecting and releasing established cognitive and motor programs, while the indirect pathway counteracts this process by inhibiting the release of such programs.



Cleanliness obsessions may show increased activity in the right **caudate nucleus** – direct pathway of the basal ganglia.



Checking compulsions may show increased activity in the **putamen** and globus pallidus – indirect pathway of the basal ganglia.

1.1 Symptomatic Manifestations and Brain

- Sexual obsessions and compulsions suggest the involvement of the **circuits** projecting through the **septum/olfactory tubercle**.
- Obsessions and compulsions associated with survival and safety issues are likely related to the circuit involving the **nucleus accumbens**.
- Social concerns involve the participation of specific **orbitofrontal circuits**.
- ✓ Decreased **dorsolateral** activity in symptomatic OCD helps understand why OCD often worsens with depression, as depression is associated with dorsolateral cortex hypoactivity.

2. Attention Deficit Hyperactivity Disorder (ADHD)

- ✓ Reduction (5%) total brain volume to difference of normal control group: Frontal lobes.
- ✓ Prominent anomalies have been reported in **subcortical regions**: basal ganglia within caudate nucleus and cerebellum.
- ✓ **Abnormal cerebellar development** may be related to the clinical course of ADHD, with smaller cerebellar volumes are associated with worse clinical outcomes.

✓ **Dysfunctions in frontostriatal and frontocerebellar systems**

- Contributing to the attention deficits, impulsivity, and behavioral regulation

For example, during a "go-no go" task, children with ADHD show lower frontal activation compared to controls.

✓ **Cerebellum**

Problems in regulating the rhythm and strength of behavior.

Children with ADHD may have difficulties controlling appropriate emotional expression due to anomalies in communication between the cerebellum and cortical regions associated with emotional control.

3. Schizophrenia

- ✓ Several studies - **cortical and subcortical regions.**
- ✓ Various neuroimaging modalities: **enlargement of the lateral ventricles**, underdeveloped temporal lobe, and **abnormalities in the frontal system.**
- ✓ Volumetric alterations aren't uniformly distributed and are primarily observed in the upper and middle temporal lobes.

Schizophrenia is clearly a disorder of multiple systems.

The symptoms of this condition can be understood in terms of connectivity problems within white matter pathways that connect different regions of the cortex.

Therefore, it is a disorder in which cortical abnormalities function together with deficits in subcortical structures.

- **Positive symptoms:**

Hallucinations and delusions have been associated with cortical connectivity.

- **Negative symptoms:**

Apathy and lack of motivation have been associated with deficits in executive function and involve the frontostriatal circuit.

Basal ganglia - Schizophrenia

Structural anomalies in basal ganglia have been observed, **including an increase in the total volume of these structures: caudate, putamen, and globus pallidus.**

Cognitive alterations:

Tasks of non-declarative learning that require specific regional striatal circuits: motor skills and probabilistic category learning.

Dopamine, glutamatergic neurotransmission has been implicated in the schizophrenia, especially in **glutamatergic synapses within the caudate nucleus.**

Cerebellum - schizophrenia

- ✓ Cerebellar dysfunction in these disorders tends to be regional

Symptomatology:

- Restricted motor symptoms - regional cerebellar dysfunction.
- Cerebellar "soft" signs in schizophrenic patients have been linked to negative symptoms, cognitive deficits, and decreased cerebellar volume.

The proposed "cognitive dysmetria" suggests a role of the **prefrontal-cerebellar-thalamic circuit** in the pathogenesis.

Dysfunction may affect the selection and correction of actions - symptoms such as auditory hallucinations and thought disorders.

4. Mapping Anatomy and Symptomology

Thought disorder is sometimes considered as a unitary entity, but is generally divided into two types:

1. Disorders of Thought Content:

Delusions: false beliefs based on incorrect inferences about external reality.

- ✓ the belief of being persecuted or having an altered identity
- Associated with cortical pathologies, especially in the right hemisphere.

2. Disorders of Thought Process and Form: Intrusion of irrelevant

ideation: changing the subject without apparent reason or expressing ideas out of context.

- Circumstantiality:** providing multiple irrelevant examples or not getting to the central point
- Dysfunctions in frontostriatal and basal circuits, as well as cortical connectivity.

5. Autism spectrum disorder

- Metabolic deficits in the **frontal and temporal cortex**. These abnormalities are associated with impaired social functioning and difficulties in processing facial expressions
- Dysfunctions in the **basal ganglia**, contributing to abnormalities in motor control and attention.
- Abnormalities in the **cerebellum** are associated with impairments in attention, language, and social adaptation.
- **Hippocampus and basal forebrain**, which contribute to emotional regulation and social behavior.
- Dysfunction in Cingulate and Orbitofrontal Cortex affects cognitive flexibility, decision-making, and emotional processing.

6. Mood disorder

Depression:

- Abnormalities in the frontal lobes, caudate nucleus, inferior and medial prefrontal cortices, and temporal lobes.
- This suggests involvement of prefrontal, basal ganglia, and paralimbic regions.

Bipolar Disorder:

Structural abnormalities have been reported in total cerebral volume, white matter, temporal lobe volumes, putamen, thalamus, amygdala, and hippocampus in individuals with early-onset.

Overall, mood disorders demonstrate involvement across multiple brain regions, suggesting a multifactorial etiology.

7. Alzheimer's Disease

Alzheimer's Disease, a prevalent cause of dementia.

Pathologically, Alzheimer's is associated with degeneration of the **temporal lobes**, the presence of **neurofibrillary tangles**, and **amyloid plaques**.

Research has revealed that individuals with Alzheimer's also exhibit significant atrophy in the posterior cerebellar lobes compared to healthy individuals.

These findings suggest that **subcortical cerebellar**.

conclusion:

- ✓ All disorders are characterized by alterations within **multiple brain networks**, which often overlap with each other, explaining certain symptom similarities between conditions.
- ✓ Neuropsychological methodologies and behavioral observations are different systems that don't merge or complement within the diagnostic categories of the DSM. It is suggested that neuropsychology may help understand these conditions due to its **descriptive and functional nomenclature**.



iThanks!

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